2.0 GENERAL SYSTEMS DESCRIPTION

The WIRE spacecraft is managed by the Goddard Space Flight Center (GSFC) SMEX Project Office and will be launched from an L1011 with a Pegasus missile. The WIRE spacecraft is provided by GSFC. The function of this spacecraft is to provide S-band coverage, to transmit data acquired by instrument, to command the instrument from the ground, and to control the pointing of the instrument. Figure 2-1 shows the WIRE spacecraft in the fully deployed configuration.

2.1 SPACECRAFT

The WIRE spacecraft consist of mechanical subsystems (primary structure and deployable mechanisms), electrical subsystems, attitude control system, communications (antennas and transponders), thermal, flight software, and a scientific instrument.

The spacecraft structure is the main load carrying structure that supports the instrument and spacecraft hardware. The primary structure is comprised of three decks (supported by a truss type structure), eight equipment panels, and eight access panels. Figure 2-2 shows the WIRE primary structure. The spacecraft measures 1.86 m high with a diameter of 85.8 cm, and weighs less than 274 kg.

2.2 INSTRUMENT

The WIRE instrument is mounted to the WIRE spacecraft with a thermally isolating interface (I/F). Figures 2-3 and 2-4 show the spacecraft and the instrument. The spacecraft provides unregulated power to the instrument. The power is generated by fixed solar arrays feeding a battery system. This system continues to provide power to the instrument during eclipse periods. The spacecraft control computer provides all command, data handling, and data storage functions for the instrument. All telemetry data and commands are handled by the spacecraft, as well as communication with the ground segment of the WIRE mission. The Spacecraft and instrument’s attitude control are managed on-board using electromagnetic torquers and momentum wheels. Sensing for fine pointing is provided by the star tracker. The star tracker data output is interfaced directly to the spacecraft Attitude Control System (ACS) via the 1553 data bus.

The telescope’s primary and secondary mirrors are diamond turned gold coated aluminum. A dichroic beam splitter and an optical band pass filter separate the focused infrared energy for viewing in two color bands (12 and 25 micrometers wavelengths). The infrared images are then captured by two 128 x 128 pixel arsenic-doped silicon detector arrays fabricated by Rockwell International.

The WIRE telescope is shown in Figure 2-5. The entire optical assembly is an integral, independent module that plugs into the cryostat. The cryostat is a two stage, solid hydrogen design fabricated by Lockheed Martin Missiles and Space (LMMS). The cryostat will cool the detector arrays to 7.5 Kelvin (K) and the optics to about 12 K for a period of four

Figure 2-1 WIRE Spacecraft

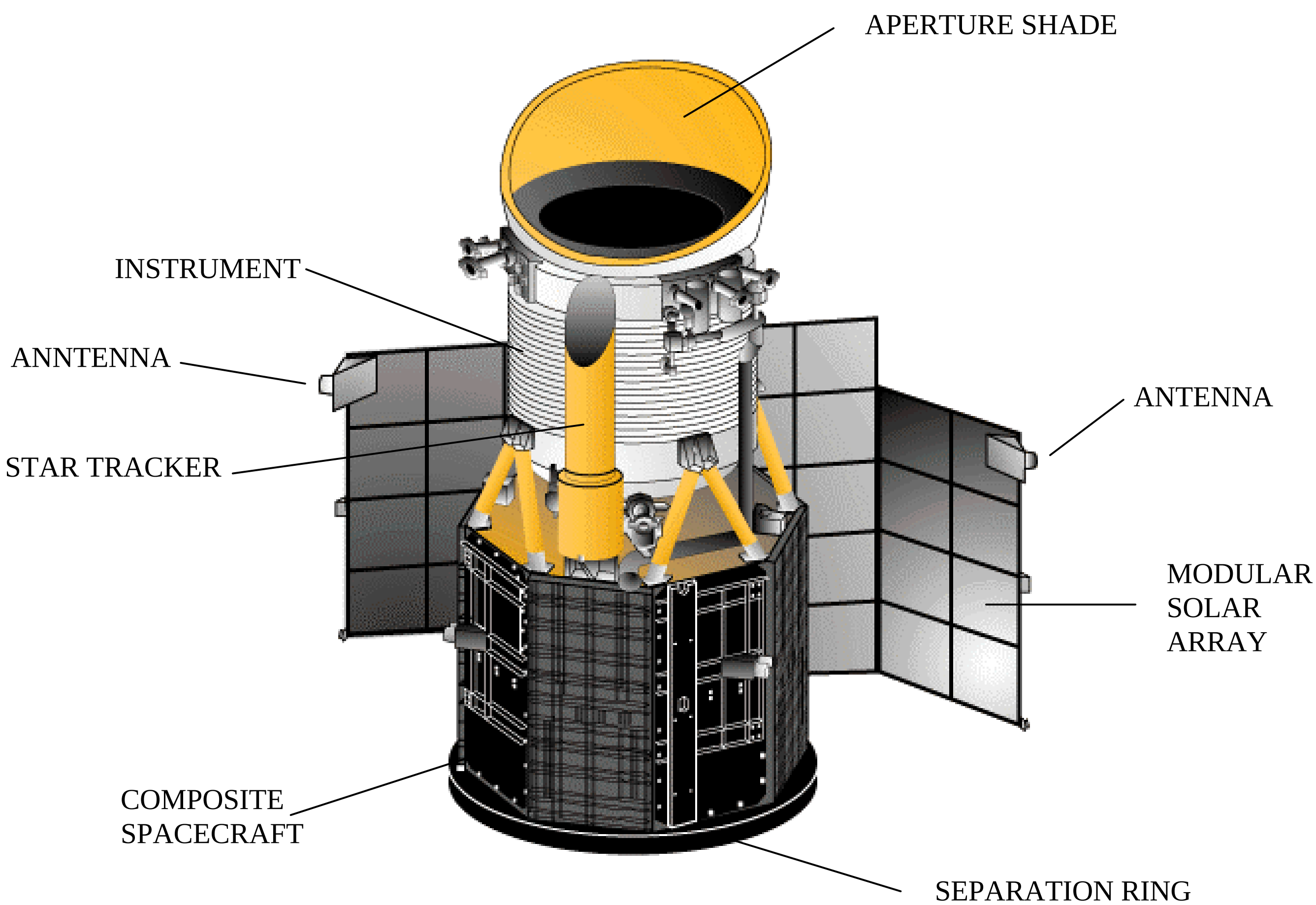


Figure 2-2 WIRE Spacecraft Primary Structure

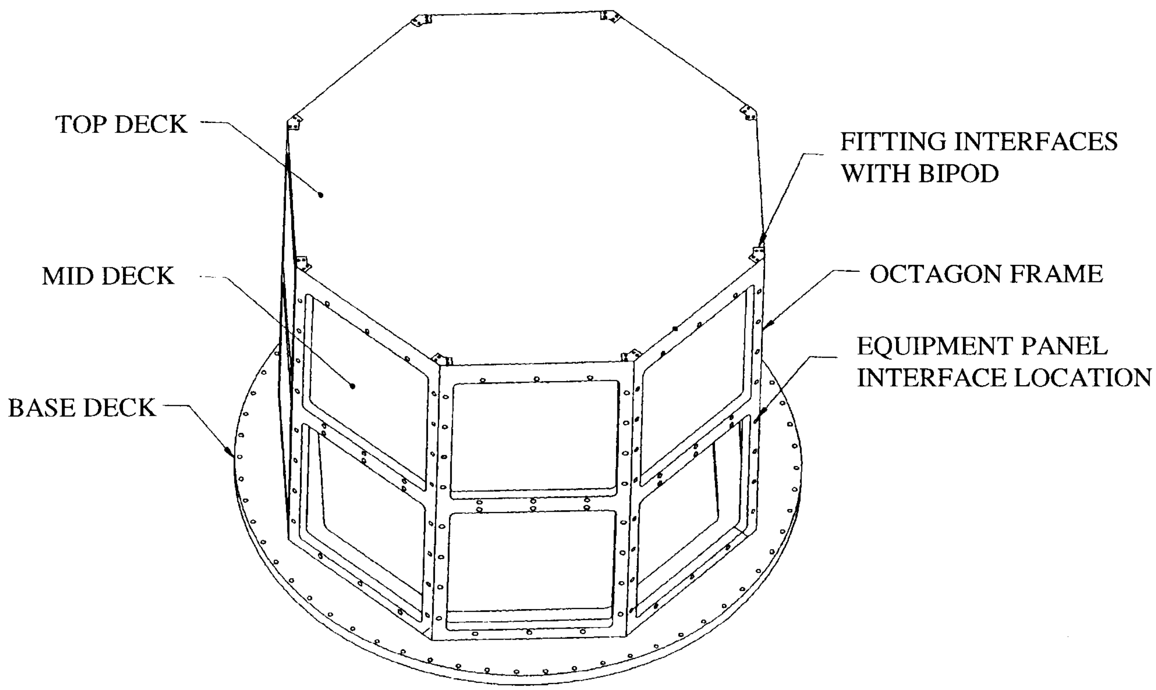


Figure 2-3 WIRE Spacecraft and Instrument (Front View)

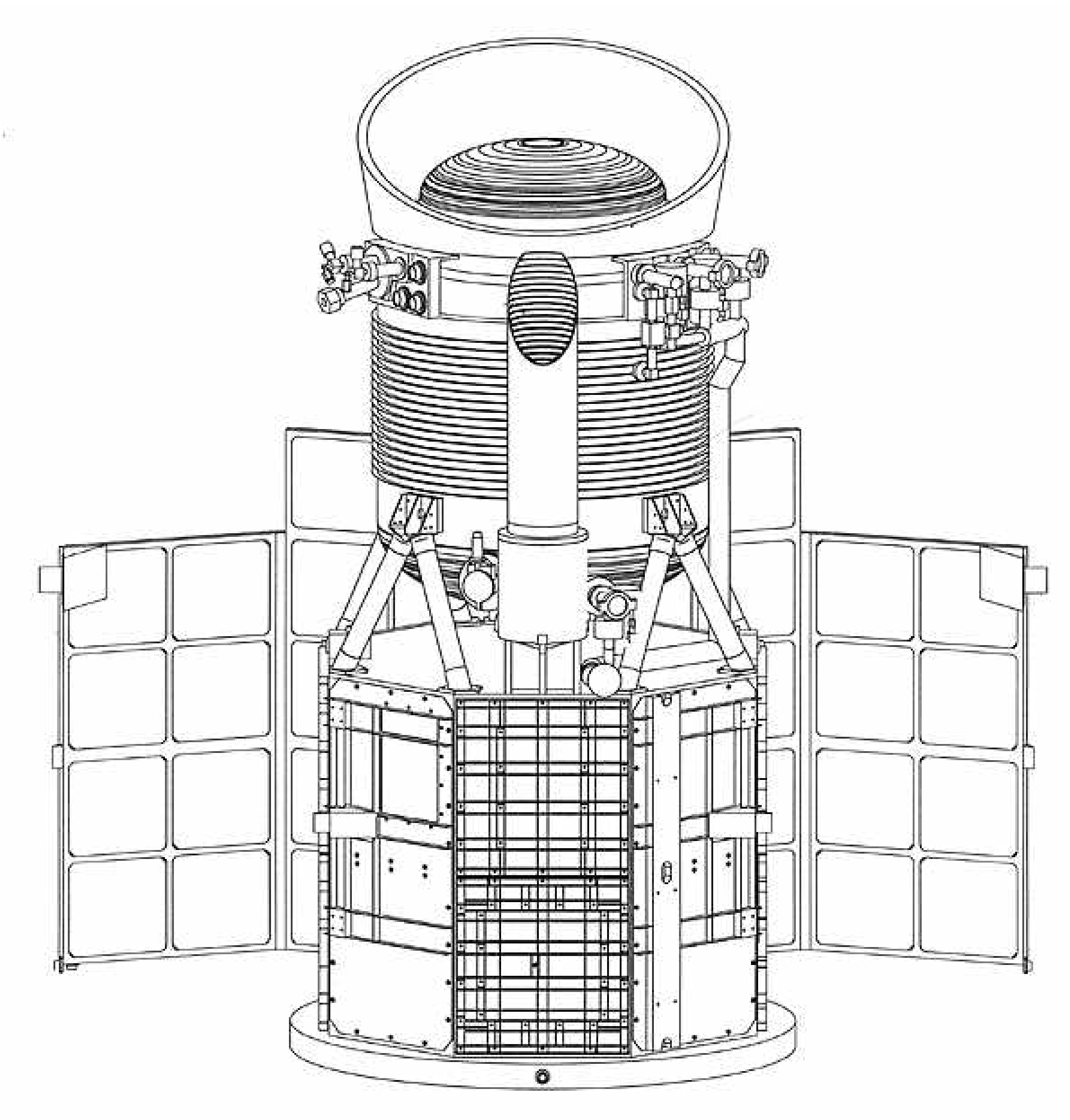


Figure 2-4 WIRE Spacecraft and Instrument (Back View)

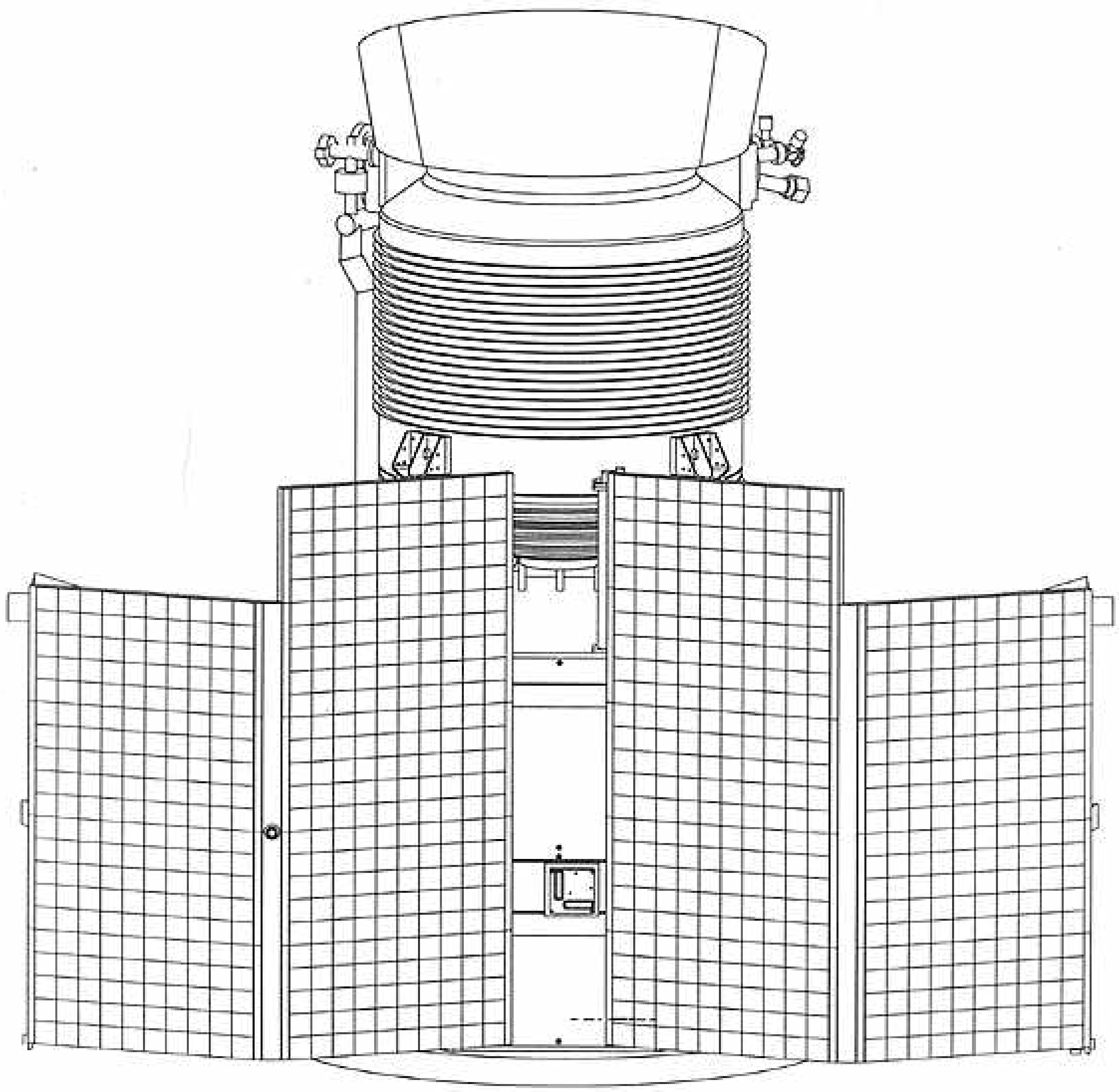
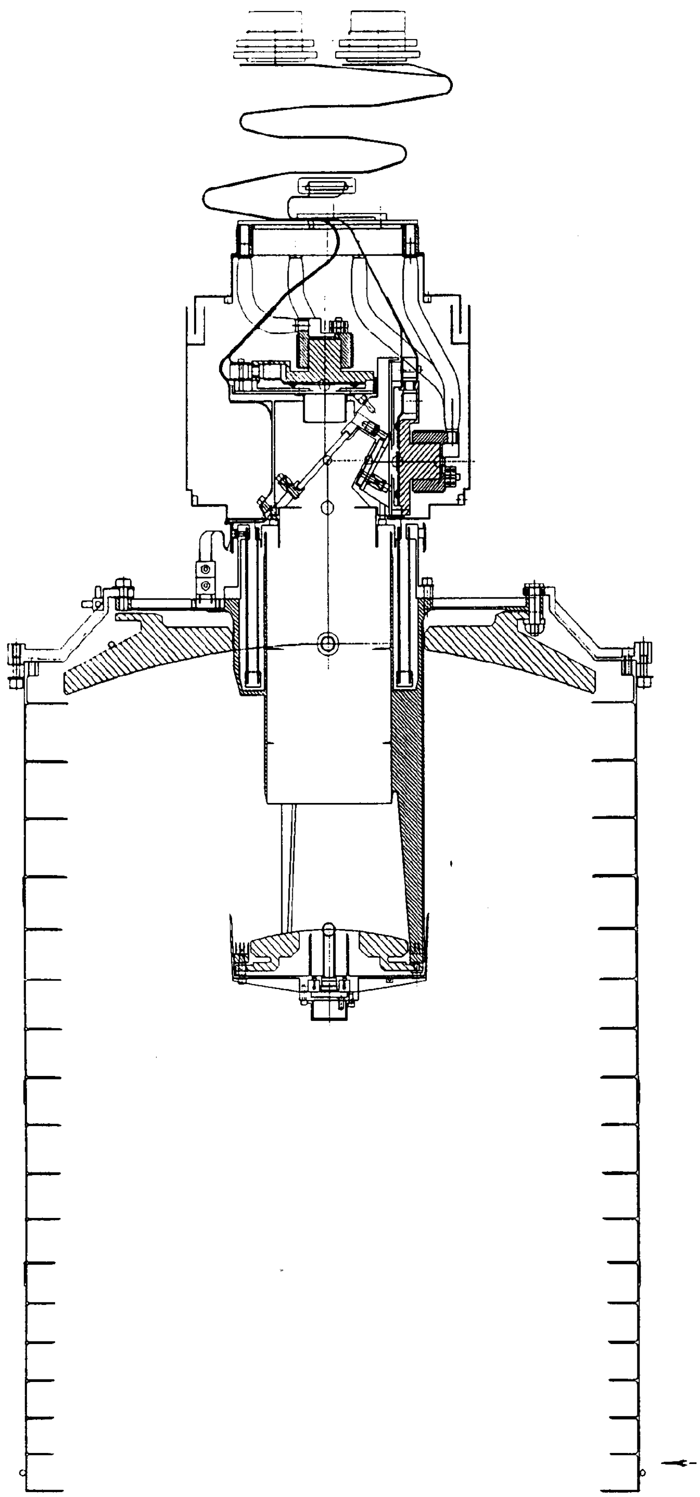


Figure 2-5 WIRE Instrument



months using about five kg of hydrogen. Solid hydrogen makes this mission possible on a Small Explorer, approximately 100 kg of helium, and a much larger tank would be required for an equivalent on-orbit lifetime. Additionally, no other cryogen can cool the detectors to 7.5 K. The entire instrument mass will be about 95 kg, including the WIRE instrument electronics (WIE) which is located inside the spacecraft. The Utah State University Space Dynamic Lab has designed and fabricated the telescope optical components so that they can be integrated with the cryostat.

2.3 GROUND AND CAPTIVE CARRY OPERATIONS

The launch processing flow, from spacecraft arrival at the WR to launch, is presented in Figure 2-6. The following are the in-line and off-line sequencing of ground processing tasks:

a. Transport of the WIRE spacecraft and associated ground support equipment (GSE) to WR to the Astrotech Payload Processing Facility (PPF).
b. Off load WIRE and GSE into the Astrotech PPF.
c. Setup GSE in the Astrotech PPF and perform spacecraft integration, test, and checkout. Some of the activities include battery charging/reconditioning, functional testing, and antenna RF checks.
d. WIRE operations in the Astrotech PPF included battery charging, short form functional testing, RF system checks, initial helium cooling, mating with the Pegasus, hydrogen filling of the instrument cryostat, and fairing installation.
e. Carrier aircraft take-off and flight to launch point.
f. Final in-flight Pegasus verifications and Pegasus vehicle arming.
g. Countdown and launch.

2.4 FLIGHT OPERATIONS

The launch and ascent phase begins with the launch of the Pegasus vehicle and continues through third stage burnout, a period of about nine minutes. The events and the order in which they take place during this phase are as follows:

a. First Stage Burnout
b. Second Stage Ignition
c. Payload Fairing Separation
d. Second Stage Separation
e. Coast Period
f. Third Stage Ignition
g. Third Stage Burnout and Orbital Insertion

Figure 2-6 R-Day Schedule